NPDES Discharge Requirements

	30 Day Average		Daily Maximum	
Parameter	**Concentration (mg/L)**	**Load (kg/day)**	**Concentration (mg/L)**	**Load (kg/day)**
1,1-Dichloroethane	0.005	0.0013	0.010	0.0027
1,1-Dichloroethylene	0.005	0.0013	0.010	0.0027
1,1,1-Trichloroethane	0.005	0.0013	0.010	0.0027
1,2-Dichloroethane	0.005	0.0013	0.010	0.0027
cis-1,2-Dichloroethylene	0.005	0.0013	0.010	0.0027
trans-1,1-Dichloroethylene	0.005	0.0013	0.010	0.0027
Vinyl Chloride	0.005	0.0013	0.010	0.0027
Trichloroethylene	0.005	0.0013	0.010	0.0027

The treated water from the DNAPL recovery system is discharged to the POTW. The Permit to Install (PTI) indicates a maximum design flow rate is 5 gpm as well as effluent concentration limits of 2.13 mg/l total toxic organics.

4.0 FINDINGS AND OBSERVATIONS FROM THE RSE SITE VISIT

4.1 FINDINGS

The RSE team observed an extremely well-managed remedy. Based on the RSE document review and site visit, the RSE team concludes that Delphi, their contractors, and EPA all have an excellent understanding of the complex site conditions, interim measures, ongoing RFI, and potential risks. Continuing efforts have been made by the site team as a whole to improve interim measures and conduct a comprehensive RFI. The observations provided below are not intended to imply a deficiency in the work of the system designers, system operators, or site managers but are offered as constructive suggestions in the best interest of the EPA and the public. These observations obviously have the benefit of being formulated based upon operational data unavailable to the original designers. Furthermore, it is likely that site conditions and general knowledge of ground water remediation have changed over time.

4.2 SUBSURFACE PERFORMANCE AND RESPONSE

4.2.1 WATER LEVELS

Water levels from the Top of Rock are collected quarterly and corresponding potentiometric maps are generated. Figures 4-1 depicts a typical potentiometric surface map for the Top of Rock unit. The regional water elevation ranges from approximately 980 feet above mean sea level (MSL) at the western property boundary to approximately 960 feet MSL at the eastern property boundary. A localized low in the water table is present at MW-424S where the water level is approximately 956 feet MSL. This low likely represents an area where water from the Top of Rock discharges to the Sugar Rock.

Water levels in the Sugar Rock are collected monthly and corresponding potentiometric surface maps are generated. The results are generally consistent from month to month with some variations due to local pumping. Figures 4-2 and 4-3 depict typical potentiometric surface maps for the Sugar Rock. The primary difference between the two maps is presumably the affect of variable pumping at the Leland/Smith facility. The water elevation across the property typically ranges from 945 feet MSL at the western boundary to approximately 915 feet MSL at the eastern boundary. No mounding is obvious near MW-424D to correspond with the cone of depression near MW-424S in the Top of Rock. Influence from pumping at P-301 at the northeastern corner of the property is evident in both figures. Although the capture zone boundary is not completely outlined, there is sufficient resolution to draw streamlines and outline the estimated horizontal capture zone. The hydraulic gradient to the east of the pumping is relatively flat for approximately 2,000 to 3,000 feet but then steepens again as it turns to the north east. The relatively flat gradient is perhaps in part due to the reduced amount of water flowing through that portion of the aquifer due to pumping from P-301 and from the Leland/Smith well to the south, which pumps an estimated 80 gpm on average. There is a relatively small component of flow from the facility to the southeast in July 2002, but it appears that a more pronounced component is present in February 2003 (Figure 4-3) in which an inward gradient for the Leland/Smith well is apparent.

4.2.2 CAPTURE ZONES

In the Top of Rock, there is no intended target capture zone and no implemented remedy because contaminated water appears to be naturally contained by the discharge of water to the underlying Sugar Rock. As shown in Figure 1-3, ground water sampling and analysis in the Top of Rock suggests that VOC contamination above MCLs is limited to four wells in the north central portion of the property (MW-422S, MW-424S, MW-425S, and MW-428S). The sampling results from other monitoring wells in the Top of Rock and interpretation of capture from the potentiometric surface map suggest that the contamination in these wells is contained horizontally. The only indications of potential TCE or cis-1,2-DCE contamination in the Top of Rock that is likely outside of the capture zone are the sampling results from 10591 Engle Road, which is approximately 500 feet to the northeast of the facility and near the Unnamed Tributary. The concentrations at this location are below MCLs and all other wells in the area (both monitoring and supply wells) have no detectable concentrations of these constituents. This well is constructed with an open interval that extends from the Top of Rock to the Sugar Rock and it is likely that TCE in this well is related to the Sugar Rock.

In the Sugar Rock, the target capture zone is the eastern property boundary. The potentiometric surface maps suggest that capture is provided for ground water leaving the northern portion of the eastern property boundary but that capture is not likely provided along the southern portion of the eastern property boundary. Sugar Rock monitoring wells (MW-401D and MW-405D) in the southern portion of the property, however, routinely have either no detectable VOC concentrations or concentrations only slightly above detection limits. The concentration trends in downgradient wells MW-413D, MW-416D, MW-418D, and MW-420D are analyzed in the progress reports to evaluate capture. Based on the trends and the potentiometric surface maps, the RSE team believes that MW-413D, MW-416D, and MW-418D are generally within the capture zone and that MW-420D is likely beyond the capture zone. One possible interpretation of the concentration trends is that concentrations in MW-413D and MW-416D are remaining relatively unchanged as impacted water travels past these points to the extraction well, and the concentrations in MW-418D have decreased as pumping has entrained cleaner water from the southern portion of the property. If this interpretation is correct, the MW-418D concentrations may stabilize either above or below the MCLs over time. Concentrations at MW-420D would be expected to continue declining until background concentrations are reached.

Contamination to the east of the capture zone will likely either naturally degrade or continue to migrate to the east and northeast until it discharges through the seeps to surface water. Contamination to the south (MW-432D, MW-441D, and MW-451D) might be captured by the Leland/Smith pumping. However, the RSE team does not have enough information regarding other extraction points to determine this conclusively.

4.2.3 CONTAMINANT LEVELS

Historical concentration data and trend plots for monitoring wells other than MW-301D, MW-413D, MW-416D, MW-418D, and MW-420D are not reported in the progress report. A cursory review of monitoring data from other downgradient monitoring wells suggests that concentrations have not yet shown a discernible decrease due to the pumping. This is expected, however, because the hydraulic gradient downgradient of P-301 is relatively flat and the ground water velocity is relatively slow. Using Darcy's law and dividing by an effective porosity, the seepage velocity in this area is approximately 0.1 feet per day assuming a hydraulic conductivity of 10^{-2} cm/sec, a hydraulic gradient of 0.001 (consistent with the potentiometric surface maps), and an effective porosity of 0.2. At this velocity, ground water may take decades to travel 1,000 feet, which is the distance to downgradient wells such as MW-419D and MW-

434D. Although this velocity is relatively small compared to the velocity required to result in the current plume extent, the velocity in this area prior to pumping was likely greater than it is now given that more ground water was moving through the aquifer rather than being extracted. A number of years may pass before concentrations in MW-419D, MW-434D, and other downgradient wells decrease as a result of containing the plume onsite. Natural degradation of TCE will likely contribute to declining concentrations. Concentrations of cis-1,2-DCE and vinyl chloride suggest that natural dechlorination is occurring or has occurred, at least in portions of the plume. With respect to risks to receptors at the seeps, TCE and cis-1,2-DCE have been detected at seeps at concentrations over 100 ug/L, but vinyl chloride has not been detected.

Contaminant concentrations in ground water beneath the facility have also not decreased. This is expected given the likely presence of DNAPL that is acting as a continuous source of dissolved phase contamination. As discussed in Section 1.5.2, DNAPL in Tank Area C appears to be limited to the upper layers of the overburden, but is a potential the source of dissolved contamination found in the underlying bedrock. Therefore, tracking DNAPL recovery is appropriate. The facility commented during the RSE site visit that the most productive DNAPL recovery wells are RW-4, RW-12, RW-5, and RW-3. An alternate possibility for the deeper dissolved contamination that persists in the bedrock is that historical DNAPL releases could have introduced DNAPL directly into the bedrock.

4.3 COMPONENT PERFORMANCE

4.3.1 DNAPL RECOVERY SYSTEM

This system did not meet operational expectations during 2000, 2001, and 2002, for two primary reasons. First, the electric submersible pump emulsified recovered product, and second, the methanol used to regenerate the resin could not be sufficiently purged from the cannister. As a result, the extracted water could not meet discharge requirements and had to be containerized. These issues have been addressed by using a pneumatic submersible pump and by relocating the drain on the resin vessels.

Though the DNAPL recovery system functions well unattended, full time supervision is used to monitor DNAPL recovery and adjust system operating parameters.

4.3.2 GROUND WATER MIGRATION CONTROL SYSTEM

Extraction System Well, Pump, and Piping

The 1.5 HP pump with a variable speed drive operates continuously at approximately 45 gpm in order to maintain a set level in the well. The pump and well have performed to expectations. Fouling has not been a problem, but the specific capacity is not reported regularly to determine if fouling is becoming an issue. The carbon steel piping outside of the building has been replaced due to corrosion. The piping inside the building has not yet been replaced.

Drewsperse

The sequestering agent Drewsperse is added to the process water prior to the air stripper feed tank. This addition has been successful at minimizing the fouling of the process pumps, filters, and GAC. Approximately 55 gallons of Drewsperse are used per month.

Air Stripper

The air stripper is capable of reaching discharge requirements without GAC polishing. It has four trays, and air is provided by a 7.5 HP blower. At sufficiently low ambient temperatures a heater warms the air that enters the building as a result of the blower operation. The heater operates approximately 7.5% of the time the system is operating. The capacity is 200 gpm, which is well above the current plant influent of approximately 45 to 50 gpm. This system operates in batch mode so that the actual flow rate through the air stripper is closer to the design capacity.

Filters and GAC

The bag filters and GAC have been bypassed because the air stripper alone is capable of meeting discharge requirements. These units could be brought back on line in the future, if necessary.

4.4 COMPONENTS OR PROCESSES THAT ACCOUNT FOR MAJORITY OF ANNUAL COSTS

Operations and maintenance (O&M) budgets for the DNAPL recovery and ground water migration control systems and the associated monitoring are approximately $265,500 per year. These costs do not include the ongoing investigations, water use survey, or municipal water connections. A breakdown of the O&M budgets are provided below based on discussions during the RSE site visit. Descriptions of these cost items and associated assumptions are discussed in the following sections.

Item Description	Estimated Cost
DNAPL Recovery System	
Operator labor and analytical for batch discharges	up to $80,000
Waste disposal	$10,000
Ground Water Migration Control System	
Weekly visits, monthly sampling/analysis, Drewsperse, and annual acid washes	$50,000
Electricity	$9,000
Ground Water, Surface Water, and Seep Monitoring	$86,500
Reporting	$30,000
Total Estimated Cost	**up to 265,500**

4.4.1 UTILITIES

The utility calculations assume an average use of 20 kW for the ground water migration control system. This usage would be more than sufficient to power the 7.5 HP blower, the 1.5 HP extraction pump, the two 1.5 HP process pumps, and approximately 5 kW for building heat, lighting, controls, and exhaust fans.

4.4.2 NON-UTILITY CONSUMABLES AND DISPOSAL COSTS

Consumables for the DNAPL recovery system are primarily limited to the methanol used to rinse or regenerate the polymer resin. Disposal is required for the DNAPL, the methanol rinse, and the treated water that is extracted during DNAPL recovery. The DNAPL and methanol rinse total approximately 15 to 20 drums per year. The treated water is discharged to the POTW.

Consumables for the ground water migration control system are primarily limited to the Drewsperse and the acid required for the annual air stripper acid washes. Approximately 55 gallons of Drewsperse are used per month. Discharge is to the surface water in accordance with a NPDES permit; therefore, costs associated with disposal are primarily for analytical, which is discussed below.

Equipment, supplies, shipping, and miscellaneous items for ground water sampling are also required. The RSE team estimates that approximately $75 per sampled well might be required. Given that approximately 208 wells are sampled each year (47 quarterly and 20 annually), the estimate consumables cost for ground water monitoring is approximately $15,600 per year.

4.4.3 LABOR

Budgeted labor includes approximately 40 hours per week for 30 weeks per year to supervise the DNAPL recovery system, a few hours per week to check the ground water migration control system and take process samples, approximately 450 to 500 hours per year for ground water sampling of 208 wells (47 quarterly and 20 annually), and an additional 80 hours per year for collecting monthly water levels. Labor is also the primary component of the reporting. Approximate costs for O&M of the two systems were provided during the RSE site visit by the site team. To estimate the costs for ground water sampling and water level measurements, the RSE team estimated approximately 2.5 hours of labor per sample and 0.25 hours per water level measurement (including mobilization and demobilization) and an approximate billing rate of $60 per hour (including overhead and profit). The estimate of 2.5 hours per sample is consistent with the site team's estimate that 5 to 8 wells can be sampled per day by one person with a facilitator.

4.4.4 CHEMICAL ANALYSIS

Approximately 5 to 10 samples per year might be required to test the treated water from the DNAPL recovery system before discharging it to the POTW. Influent and effluent samples are collected monthly from ground water migration control system and are analyzed using method 624.1. Also, the samples from approximately 208 wells (47 quarterly and 20 annually) plus the associated quality assurance samples are analyzed using method 8260b. Approximate costs for O&M (including process samples) of the two remediation systems were provided during the RSE site visit by the site team, but to estimate the costs for analysis of ground water samples, the RSE team estimated approximately $125 per sample. It also assumes that approximately 40 to 50 additional samples per year require analysis for quality assurance (i.e., field blanks, trip blanks, and blind duplicates) and an additional 20 samples per year require analysis for the surface water and seep sampling.

4.5 RECURRING PROBLEMS OR ISSUES

Recurring problems associated with the two active remediation systems have reportedly been addressed. For the DNAPL recovery system this included using a pneumatic pump and moving the drain for the resin canisters to the bottom to facilitate draining of the methanol rinse. For the ground water migration control system this included the addition of the sequestering agent Drewsperse to minimize fouling of process pumps and other units.

The predominant recurring problem that needs continuing attention is the discharge of contaminated ground water in the overburden to the storm sewers and the subsequent discharge of that water to either surface water or to land surface. During precipitation events, the infiltrated water collects in abandoned storm drains and mounds at the end with a lower elevation. The problem is perhaps augmented by a leak in a water supply line on the southern portion of the facility. The site team has replaced some storm sewers and is currently using a sump pump in a storm sewer manhole to extract the collecting water. The extracted water is stored in frac tanks and is treated by a mobile unit at approximately $0.10 per gallon. Concentrations at times have been as high as 50,000 ug/L and the extraction rate may be as high as 10 gpm. The current plan is to remove infiltration tiles that facilitate infiltration of precipitation, address the leak in the water supply line, convert an abandoned storm sewer into a collection trench, and pump collected water to the ground water migration control treatment system (approximately 1,200 feet away). Because that system currently treats and discharges 45 to 50 gpm, a modification of the NPDES permit will be required to increase the current discharge rate from 50 gpm. The air stripper has sufficient capacity to treat the additional water.

4.6 REGULATORY COMPLIANCE

The DNAPL recovery and ground water migration control system meet the applicable air and water discharge requirements. Discharge of contaminated ground water to surface water through storm sewers is currently being addressed as discussed in Section 4.5.

4.7 SAFETY RECORD

The site team did not report any health and safety incidents during the site visit.

5.0 EFFECTIVENESS OF THE SYSTEM TO PROTECT HUMAN HEALTH AND THE ENVIRONMENT

5.1 GROUND WATER

The water use survey has been conducted to identify supply wells in the area. Information on properties downgradient of the facility was gathered by a door-to-door survey and other records. Information on the other properties is being collected via a mailed questionnaire. Where active wells are operated and permission is granted, samples were collected for analysis of VOCs with method 524.2. As reported in the Interim Measures and Implementation Report, 73 samples were collected from 42 locations. Of those samples, 58 had no detectable levels of VOCs. VOCs were detected, however in 15 samples from 11 locations. The site team is working with those properties to provide connections to municipal water. One property along Engle Road, to the north, has detectable concentrations of TCE and cis-1,2-DCE and is not located near a municipal water line. The site team is monitoring this well, but does not report any current plans to supply water or a point-of-entry treatment system.

5.2 SURFACE WATER

Current efforts are underway to address the overburden ground water; however, more permanent efforts with a greater capacity for extraction and treatment will be required. The use of an abandoned storm sewer as a collection trench and treating the collected water in the ground water migration control system treatment plant will likely provide this more permanent solution.

Ground water with TCE concentrations exceeding 100 ug/L is discharging to the surface through seeps along the Great Miami River valley. Although the ground water migration control system is in place to contain ground water in the Sugar Rock aquifer beneath the facility, discharge of impacted water through these seeps a mile downgradient will likely continue for decades. Although the TCE and other VOCs in this seep water will likely volatilize before reaching the river, these rivulets that are formed by the seeps may be accessible to the public. The site team indicated during the RSE visit that an ecological risk assessment will be performed and subsequent consultations with the State are required to determine if any measures are required to address these seeps.

5.3 AIR

The current interim measures do not address the potential for vapor intrusion; however, the investigation and further evaluation of vapor intrusion are to be conducted during the RFI that is currently underway. One area of the facility to be investigated is the east tunnel, which is adjacent to the former Tank Area C where DNAPL has been observed.

5.4 SOILS

The current interim measures do not address soil contamination; however, the investigation and further evaluation of vapor intrusion are to be conducted during the RFI that is currently underway. The RFI work plan identifies 8 areas of interest (AOIs) that require confirmation sampling and 29 AOIs that require investigation.

5.5 WETLANDS AND SEDIMENTS

The wetlands and sediments that may be affected are associated with the surface water discussed in Section 5.4.

6.0 RECOMMENDATIONS

Cost estimates provided herein have levels of certainty comparable to those done for CERCLA Feasibility Studies (-30/+50%), and these cost estimates have been prepared in a manner consistent with EPA 540-R-00-002, *A Guide to Developing and Documenting Cost Estimates During the Feasibility Study*, July 2000.

6.1 RECOMMENDATIONS TO IMPROVE EFFECTIVENESS

6.1.1 EVALUATE POTENTIAL PUBLIC CONTACT WITH SEEPS AND CONSIDER POSTING SIGNS AT SEEPS DISCHARGING IMPACTED WATER

The ground water seeps at the Sugar Rock outcrops located along the Great Miami River valley form rivulets that eventually discharge to the Great Miami River. Although the VOCs may volatilize prior to reaching the river, and the seeps are generally inaccessible to the public, the public may access some of the impacted seeps. The RSE team suggests that the potential for public contact with water from the seeps be more fully evaluated. Based on the results, signs to notify the public that the water is not suitable for drinking could then be considered. Note that the RSE team did not view the seeps from a nearby bike path during the site visit to assess proximity and accessibility, and the site team should use its best judgment in interpreting the recommendation's intent of protecting human health and the environment. If implemented, this recommendation should cost less than $5,000.

6.1.2 CONSIDER PROVIDING A POINT-OF-ENTRY TREATMENT SYSTEM FO 10591 ENGLE ROAD

The residence at 10591 Engle Road has a potable well impacted by VOCs with concentrations below the MCLs. Municipal water is not available in the that area, so a municipal water hookup cannot be provided for that residence. The facility has provided municipal water connections for houses along Cassel Road, even if concentrations were not above standards. The facility may likewise wish to consider providing and maintaining a point-of-entry treatment system for 10591 Engle Road to mitigate the impacts and reduce the liability. The estimated cost for implementing this recommendation is approximately $2,000 in capital costs and $1,000 per year in annual costs.

6.1.3 PROCEED WITH PLANNED CONNECTION OF OVERBURDEN GROUND WATER EXTRACTION TO THE EXISTING TREATMENT SYSTEM

The RSE team recommends proceeding with the proposed interim measures to address the impacted overburden ground water that occasionally discharges to surface water through storm sewers or to the surface through seeps. The site team's approach of converting abandoned storm sewers to collection trenches and pumping extracted water to the existing treatment system for the ground water migration control system appears reasonable. The primary cost involved will likely be laying the pipe and controls to convey the water to the treatment system. For the approximate 1,200 feet of pipe that will be required, the facility estimates a cost of $75,000.

The increase in the flow rate and the high concentrations may require adjustments to the treatment system. The water from the overburden has concentrations as high as 50,000 ug/L. Given the added mass loading, adjustments to the system may be required. Cost-effective options are add trays to the air stripper and/or recycle some of the air stripper effluent into the feed tank on a continual basis. Recycling would effectively dilute air stripper influent and would likely allow it to continue meeting the discharge standards without requiring the use of the GAC polishing units. The air stripper capacity is 200 gpm, and the current flow rate is approximately 45 to 50 gpm. Therefore, even if the extraction rate from P-301 is increased by 10 gpm and the flow from the overburden provides an additional 10 gpm, the total influent flow will by approximately 70 gpm and the capacity is available for this approach.

The modifications would require some repiping at a relatively low cost, perhaps $5,000 to $10,000. The annual costs would primarily be due to the increase in electricity required to operate the air stripper at a higher batching frequency. This compares favorably to re-incorporating the filters and GAC units, which would require regular replacement and might be prone to fouling. Based on the information provided, the RSE team estimates a capital expenditure of approximately $100,000 for the 1,200 feet of trenching, the conversion of a sewer into a collection trench, modifications to the air stripper, and modifications to the NPDES permit. Annual costs might increase by $10,000 (up to $5,000 for additional electricity and up to $5,000 for additional maintenance).

6.1.4 PROCEED WITH PLANNED LOWERING OF THE EXTRACTION PUMP IN P-301

Although potentiometric surface maps appear to indicate that capture is achieved along the northern portion of the site, an increase in the extraction rate is appropriate. The added cost is minor (only the cost of electricity associated with increasing the air stripper batch frequency), and the additional extraction will make capture even easier to interpret from the potentiometric surface maps. The capture zone would also be wider and would likely include the southern portion of the site.

6.1.5 AVOID ALTERING SITE HYDROGEOLOGY - DO NOT SEAL BORINGS FROM OLD PRODUCTION WELLS

During the RSE site visit there was discussion about potentially eliminating the hydraulic connection between the Top of Rock and Sugar Rock in an effort to prevent additional contamination from migrating to the Sugar Rock. The RSE team believes that the site team has a strong understanding of the hydrogeology at this relatively complex site and discourages efforts to alter that hydrogeology. The current conditions and remedy appear to contain contamination on site in both the Top of Rock and the Sugar Rock. If the connection were to be eliminated, migration control would be required in both the Top of Rock and Sugar Rock for a number of years. The performance of the current system is known and appears effective, but the performance of a future scenario is unknown and may not be as effective.

6.2 RECOMMENDATIONS TO REDUCE COSTS

6.2.1 CONSIDER MODIFICATIONS TO GROUND WATER MONITORING PROGRAM

The presence of DNAPL and the large area of the downgradient plume make it likely that the final remedy will require decades of operation, maintenance, and monitoring. As a result, the monitoring program should be refined to clearly and cost-effectively provide the data necessary to evaluate remedy performance. The collection, interpretation, and reporting of unnecessary or redundant data is costly and distracts from the data required for performance evaluation. Assuming the primary the primary goal of any corrective

measure at the site is to contain contamination on site, stabilize the plume, and monitor aquifer restoration, the RSE team has the following recommendations for modifying the current ground water monitoring program into a more appropriate long-term monitoring program.

Water levels

Water levels in the Sugar Rock should continue to be measured. The potentiometric surface maps should continue to be generated and interpreted for capture on a monthly basis for one year after the pumping rate in P-301 is increased. After this one-year period, water levels should be conducted on a quarterly basis in the overburden, Top of Rock, and Sugar Rock.

Ground water sampling and analysis

Overburden - Once the RFI is complete, sufficient information will be available to optimize the long-term monitoring program for the overburden. Because these data are not yet available, the RSE team cannot provide specific feedback at this point. However, the general recommendation is that each well and each sampling event in the monitoring program provides specific information that is needed to evaluate the remedy performance and is not provided by another well. A limited number of wells within the plume should be sampled, and they likely should be sampled on an annual basis because the progress toward restoration will take decades and quarterly measurements will not likely provide any additional value. The majority of sampling in this unit should be reserved for wells that delineate the plume and can be used as performance monitoring wells or sentinel wells downgradient of the expected capture zone for evaluating plume migration or the control of plume migration.

Top of Rock - The currently available ground water quality information for this unit should be used to establish a target capture zone that would likely encompass MW-422S, MW-424S, MW-425S, and MW-428S. If capture as interpreted by the potentiometric surface maps routinely and comfortably encompasses the target capture zone, then additional sampling in this formation can be limited. Select wells, perhaps one well within the plume and up to 8 wells delineating the plume can be sampled every five years to confirm migration control is still achieved. The potable drinking well at 10591 Engle Road (which has detectable VOC concentrations below MCLs) should likely be sampled quarterly, and the wells at the immediately surrounding properties (which do not have detectable VOC concentrations) should likely be sampled annually.

Sugar Rock - The RSE team recommends evaluating the Sugar Rock ground water monitoring. One potential approach could be to reduce the sampling frequency from quarterly to annual. In addition, a number wells may be redundant because they are located within a plume that, given the options for remedial action, is not likely to be restored for decades. The team could discuss which wells provide necessary data for evaluating remedy performance and which wells are redundant. The RSE team suggests that the following wells be sampled annually as performance monitoring wells for the P-301 capture zone: MW-409D, MW-418D, MW-419D, MW-420D, MW-433D, and MW-434D. In addition, MW-444D, MW-448D, MW-450D, and MW-453D (or perhaps an additional well that delineates the contamination at MW-453D) could be sampled annually as sentinel wells to determine if contamination continues to migrate beyond the current plume area. Other wells could also be sampled, depending on site-specific needs the RSE team has not fully considered. If the current interim remedy (with additional pumping from P-301) becomes the final remedy, the above sampling program might be appropriate for evaluating the performance over the long-term. Other remaining site wells could be included in the annual sampling or monitored every few years to evaluate the progress toward restoration.

Ground water seeps at Sugar Rock outcrop

Sampling and analysis of these seeps should continue on an annual basis.

Reporting

Monitoring reports should be produced annually to accompany the annual sampling event, but progress/O&M reports should likely continue quarterly. In addition to the information provided in the current reports, each annual report should present the following:

- tables with historical sampling and water level data for all wells
- trend plots of the sampling data from wells with detectable concentrations, compared to expected trends
- potentiometric surface maps for each unit that include the target capture zone and the interpreted capture zone depicted by streamlines
- a discussion of how the potentiometric surface map was generated and how the capture zone was interpreted including the known pumping conditions at the time the water levels were collected
- an evaluation of remedy performance relative to the remedy goals based on the current and previous sampling and water level data
- suggestions for alternative remedial approaches, if the remedy does not appear to be achieving its goals

The RSE team notes that the above suggestions are based on the data reviewed during the RSE project and additional data will subsequently become available from the RFI and other investigations. If known changes in other regional pumping are made (e.g., at the Leland Electrode Systems facility) as observed from potentiometric surface maps, changes in this suggested monitoring program would likely be required. In addition, the above recommendations generally assume that the final remedy will closely resemble the interim measures. If other remedial strategies are considered or required, the monitoring requirements would likely change.

The cost savings of reducing the frequency for water level measurements from monthly to quarterly may be partially offset because the recommendation includes collecting water levels in the overburden. Cost savings could result from reducing the number of monitored wells and the monitoring frequency. The example monitoring program provided by the RSE team includes sampling of approximately 11 wells once per year in the Sugar Rock, a limited number of wells in the overburden, and perhaps a few additional wells. Assuming up to 7 wells are sampled in the overburden once per year, 5 additional wells beyond those mentioned by the RSE team are sampled in the Sugar Rock, and up to 10 additional wells throughout the site are measured every two years, this example monitoring program would involve a fraction of the monitoring associated with the current program (23 samples per year and up to 10 additional wells every two years versus 208 samples per year). Based on the costs of the current monitoring program, the proposed monitoring program (excluding reporting) should cost approximately $17,000 per year on average compared to the current cost of $84,000. The cost for reporting would likely decrease by approximately $5,000 from $30,000 per year to $25,000 per year.

6.3 MODIFICATIONS INTENDED FOR TECHNICAL IMPROVEMENT

6.3.1 CONSIDER REPLACEMENT OF TREATMENT SYSTEM PIPE

The carbon steel piping on the outside of the treatment building has been replaced due to corrosion. When replacement of the carbon steel piping on the inside of the building is required, it should be replaced by schedule 80 PVC, which is corrosion resistant. The costs for using PVC would not be substantially different than carbon steel piping.

6.4 CONSIDERATIONS FOR GAINING SITE CLOSE OUT

The presence of DNAPL beneath the facility offers a continuing source of dissolved ground water contamination. The RSE team recognizes that the DNAPL recovery system is an appropriate measure for removing recoverable free product, especially given the extent of this DNAPL, operations at the overlying facility, and the potential for mobilizing DNAPL if other technologies are used. The RSE team also acknowledges that DNAPL will remain in the subsurface for decades even after DNAPL recovery is discontinued (residual, unrecoverable DNAPL will remain). At this time, the RSE team does not know of an appropriate technology that could guarantee remediation of the DNAPL at a practicable cost. Some approaches may not be appropriate for the site. For example, the use of six-phase heating would likely be inappropriate because the vadose zone is too thin and too tight to effectively recover the resulting VOC vapors. In addition, the heat generated from six-phase heating (or chemical oxidation) could upset above-ground facility operations. Injection of nano-scale iron is typically reserved for dissolved contamination and is generally not effective for DNAPL or residual DNAPL. Some bioremediation approaches may be appropriate, but should be considered after DNAPL recovery stops. The RSE team believes that an appropriate approach would be to continue operating the ground water migration control system and evaluate various DNAPL remediation technologies on regular basis, perhaps every five years.

The area downgradient of the ground water migration control system capture zone will also likely remain well above standards for decades due to a relatively slow flushing rate of clean water through the contaminated zone and the large contaminated area. Reinjection of treated water could facilitate this flushing, but the reinjected water would disperse (not destroy the contaminants) and, due to aeration, might slow the natural reductive dechlorination that is taking place. The use of alternate technologies for this downgradient plume would also require substantial expense due to the broad area of impacts (nearly a square mile) and the cost of distributing reagents over this wide area. Assuming a radius of influence for an injection well of 50 feet, the area of influence would be approximately 10,000 square feet. Assuming a plume area of approximately one square mile (approximately 25 million square feet), approximately 250 injection wells would be required. At an estimated cost of $10,000 per injection well, the delivery costs alone would be approximately $2.5 million. Additional costs would be required for planning, materials, monitoring, and oversight and the results would not be guaranteed. Once the EIs are met, the RSE team believes that an appropriate approach would be to continue operating the ground water migration control system and maintain institutional controls through the plume area, potentially reviewing various remediation technologies on regular basis, perhaps every five years, to determine if a technology is developed that can practicably achieve aquifer restoration or other site goals.

6.5 Suggested Approach to Implementation

The RSE team is impressed with the work conducted at the site and encourages the site team to move forward with the RFI and meeting the EIs. The recommendations provided above are not necessarily contingent on each other. The site team likely has a better understanding of how to implement these recommendations in conjunction with ongoing site activities.

7.0 SUMMARY

The RSE team observed an extremely well-managed remedy. Based on the RSE document review and site visit, the RSE team concludes that Delphi, their contractors, and EPA all have an excellent understanding of the complex site conditions, interim measures, ongoing RFI, and potential risks. Continuing efforts have been made by the site team as a whole to improve interim measures and conduct a comprehensive RFI. The observations and recommendations contained in this report are not intended to imply a deficiency in the work of either the system designers or operators but are offered as constructive suggestions in the best interest of the EPA and the public. These recommendations have the obvious benefit of being formulated based upon operational data unavailable to the original designers.

To enhance effectiveness, the RSE team provides five recommendations. Two of the recommendations are for the site team to continue with proposed plans of piping extracted water from the overburden to the existing treatment system and lowering the pump in the extraction well to allow for an increased extraction rate. The other recommendations are to consider providing a point-of-entry treatment system for one property, to more fully evaluate the potential for public contact with seeps and add signs as appropriate, and to avoid altering the site hydrogeology that could result from sealing the connections between the Top of Rock and Sugar rock aquifers. To reduce costs and maintain protectiveness, the RSE team recommends modifying the ground water monitoring plan. General concepts and some specific modifications to the sampling and reporting are mentioned; however, the current RFI and upcoming final remedy may require a different monitoring plan. Only one technical improvement recommendation is made, and it involves the eventual replacement of corroding pipe. For site closure, the RSE team acknowledges that decades of remediation will be required and that current technologies will not likely restore the aquifer. The RSE team recommends continuing to control plume migration and to review innovative technologies, particularly for the source area, and evaluate appropriate technologies every five years.

Table 7-1 summarizes the costs and cost savings associated with each recommendation in Sections 6.1 through 6.3. Both capital and annual costs are presented. Also presented is the expected change in life-cycle costs over a 30-year period for each recommendation both with discounting (i.e., net present value) and without it.

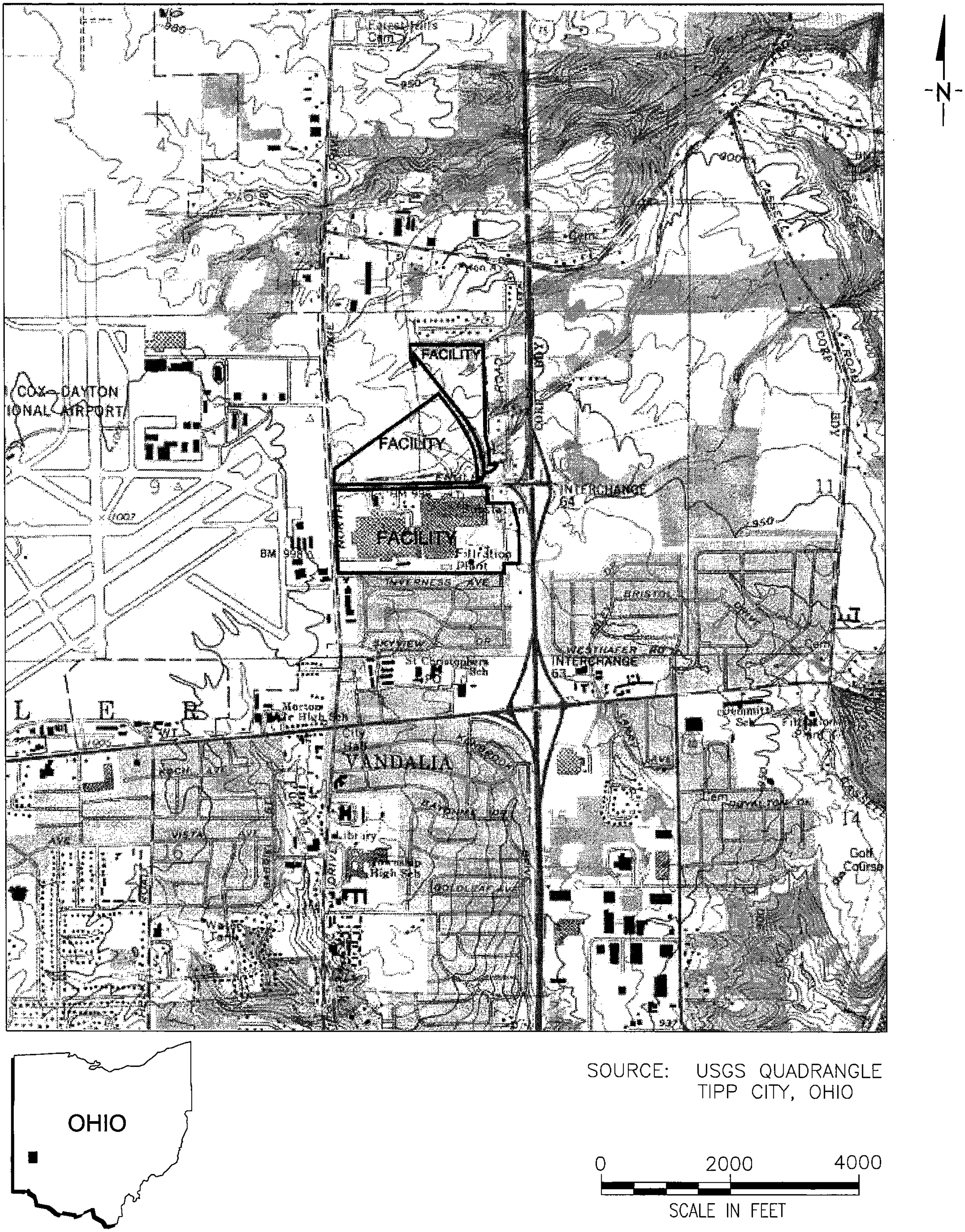
Table 7-1. Cost Summary Table

Recommendation	Reason	Additional Capital Costs ($)	Estimated Change in Annual Costs ($/yr)	Estimated Change In Life-cycle Costs ($) *	Estimated Change In Life-cycle Costs ($) **
6.1.1 Evaluate Potential Public Contact With Seeps, Consider Signs	Effectiveness	$5,000	$0	$5,000	$5,000
6.1.2 Consider Providing a Point-of-Entry Treatment System fo 10591 Engle Road	Effectiveness	$2,000	$1,000	$32,000	$18,100
6.1.3 Proceed with Planned Connection of Overburden Ground water Extraction to the Existing Treatment System	Effectiveness	$100,000	$10,000	$400,000	$261,400
6.1.4 Proceed with Planned Lowering of the Extraction Pump in P-301	Effectiveness	$0	$0	$0	$0
6.1.5 Avoid Altering Site Hydrogeology - Do Not Seal Borings from Old Production Wells	Effectiveness	$0	$0	$0	$0
6.2.1 Consider Modifications to Ground Water Monitoring Program	Cost Reduction	$0	($67,000)	($2,010,000)	($1,081,400)
6.3.1 Consider Replacement of Treatment System Pipe	Technical Improvement	$0	$0	$0	$0

Costs in parentheses imply cost reductions.
* assumes 30 years of operation with a discount rate of 0% (i.e., no discounting)
** assumes 30 years of operation with a discount rate of 5% and no discounting in the first year

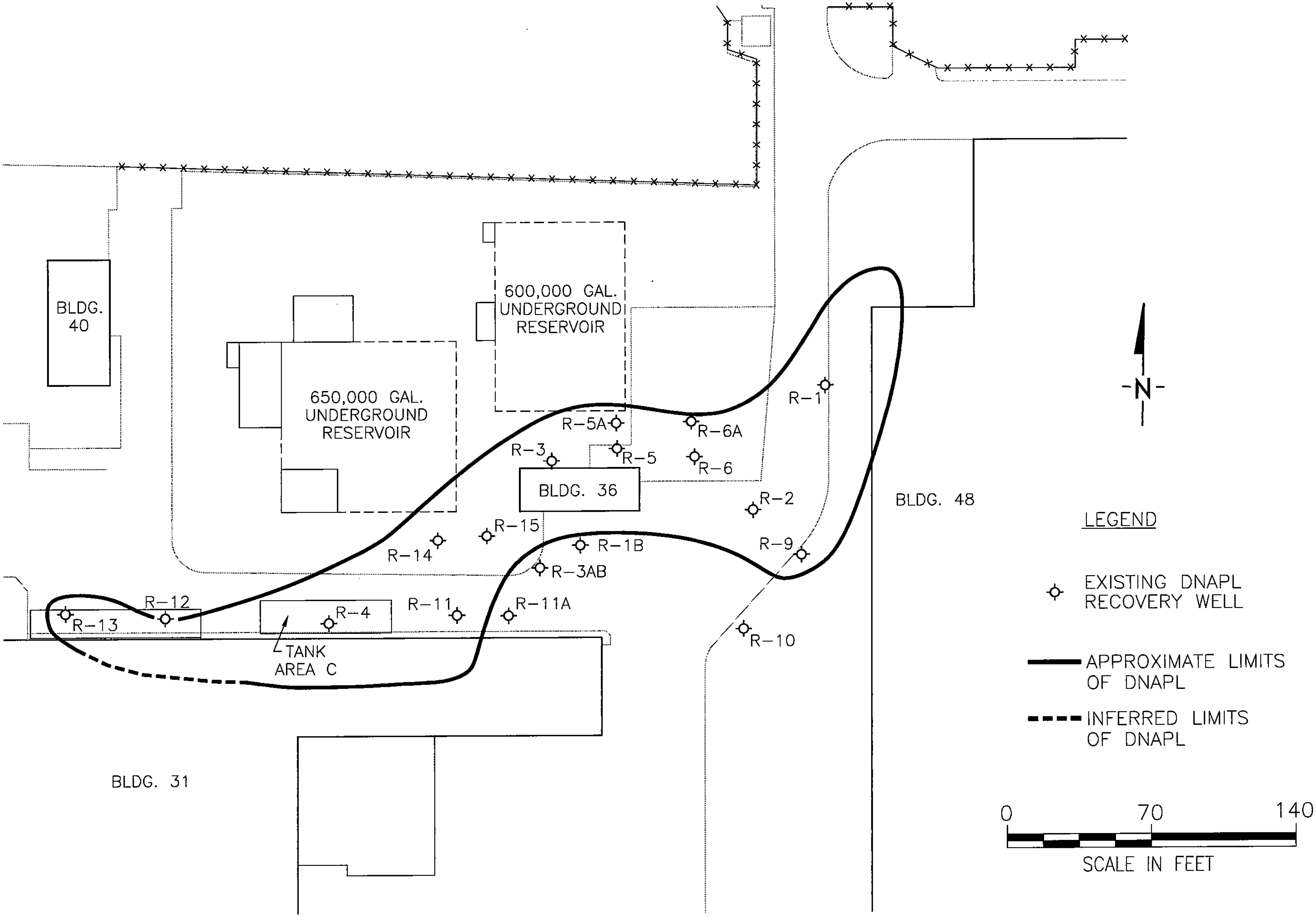
FIGURES

FIGURE 1-1. THE DELPHI FACILITY AND THE SURROUNDING AREA



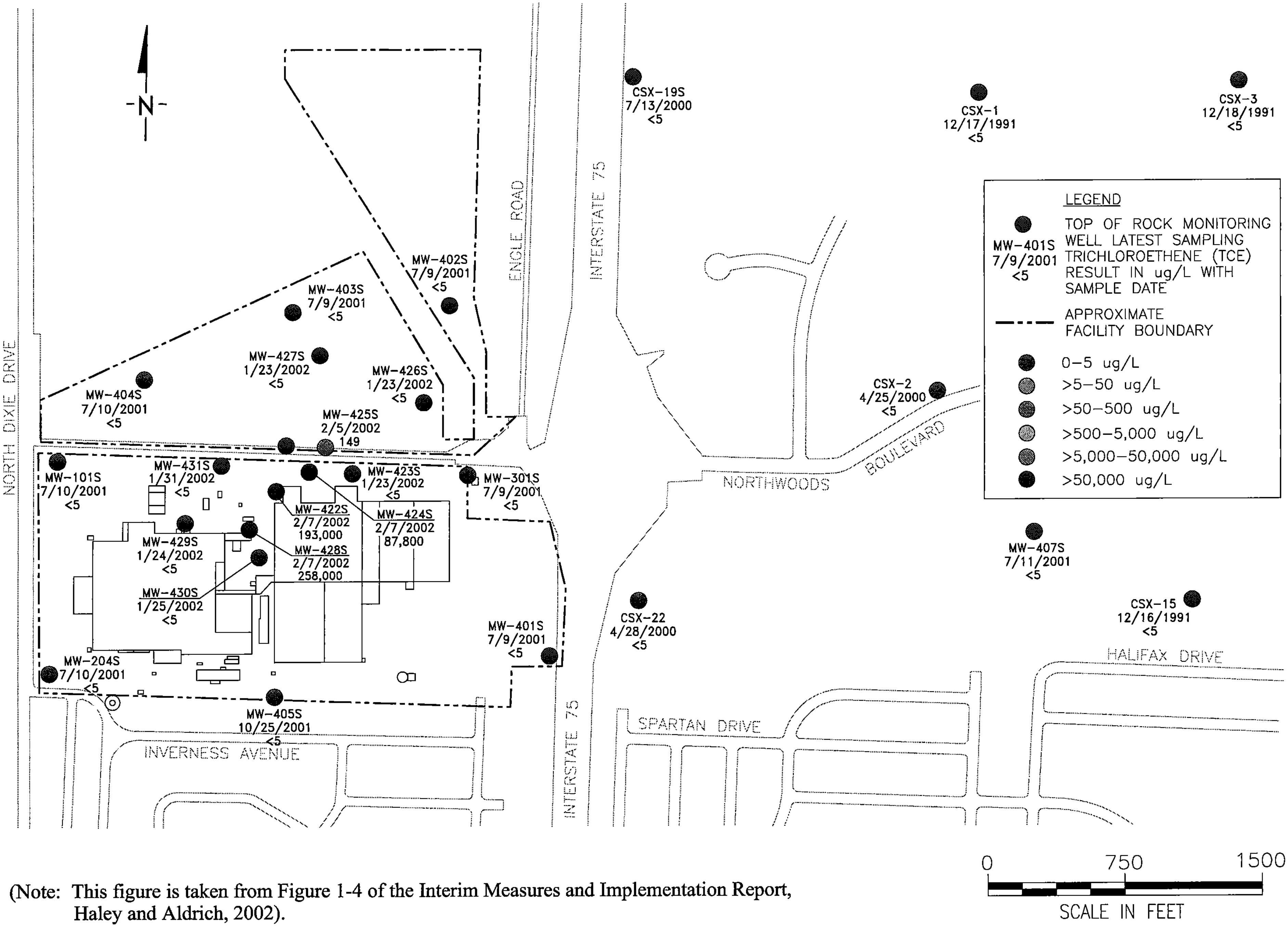
(Note: This figure is taken from Figure 1 of the RCRA Facility Investigation Work Plan, Haley and Aldrich, 2002.)

FIGURE 1-2. EXTENT OF DNAPL AND LOCATIONS OF DNAPL RECOVERY WELLS IN FIRST SAND UNIT OF OVERBURDEN



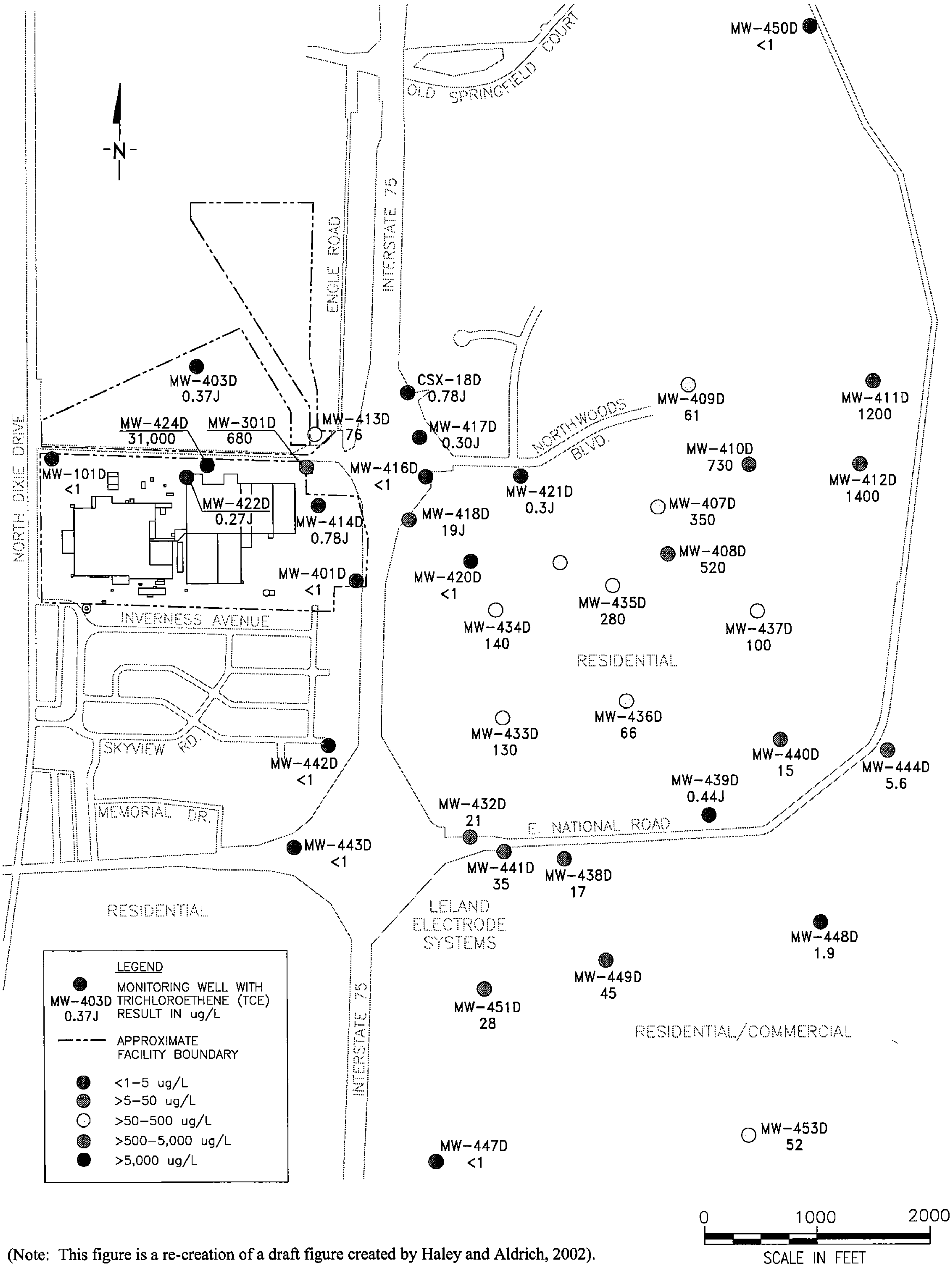
(Note: This figure is a re-creation of Figure 2-2 from the Interim Measures and Implementation Report, Haley and Aldrich, 2002).

FIGURE 1-3. TCE DISTRIBUTION IN THE TOP OF ROCK



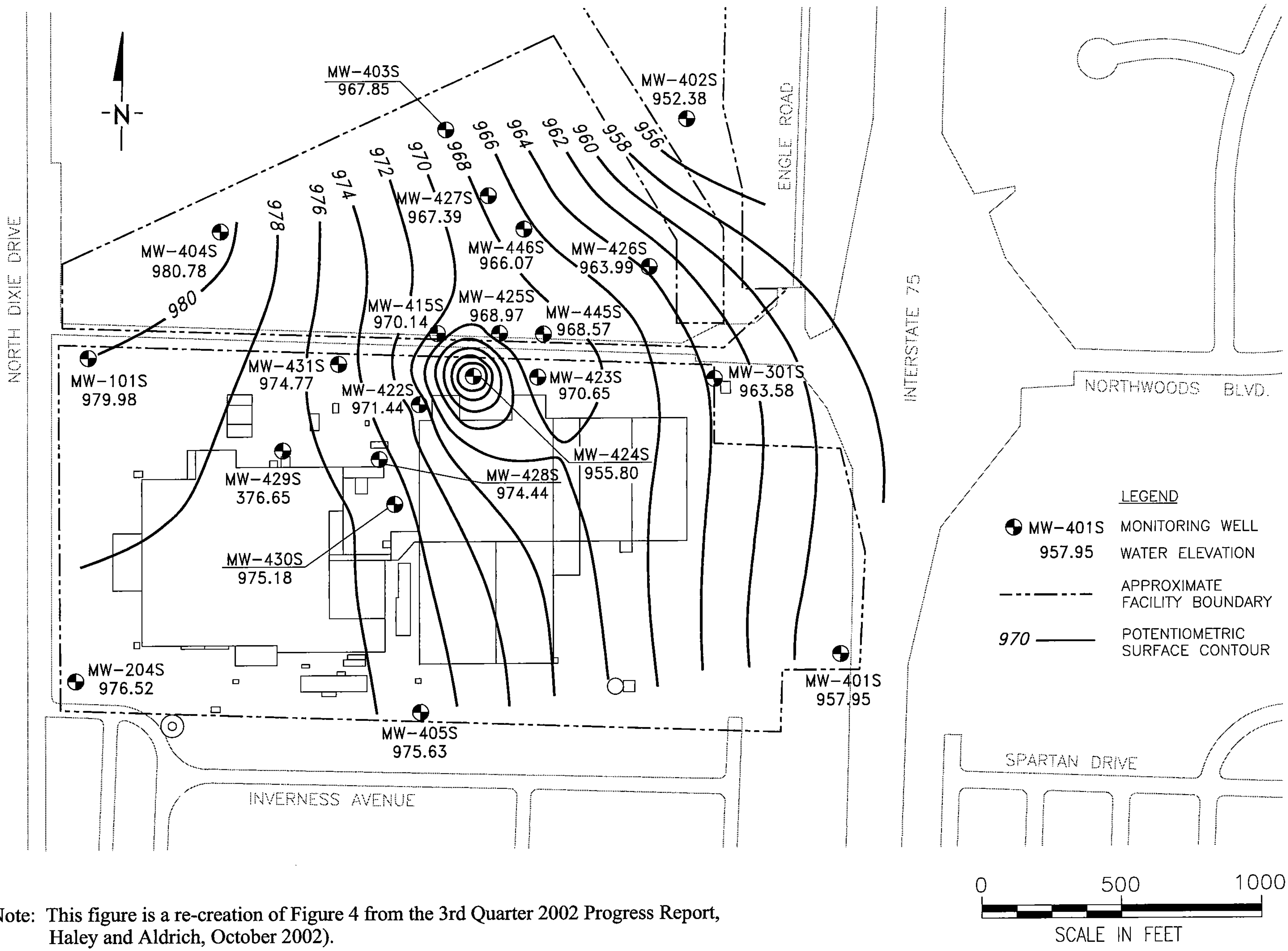
(Note: This figure is taken from Figure 1-4 of the Interim Measures and Implementation Report, Haley and Aldrich, 2002).

FIGURE 1-4. TCE DISTRIBUTION IN THE SUGAR ROCK, FIRST QUARTER 2003



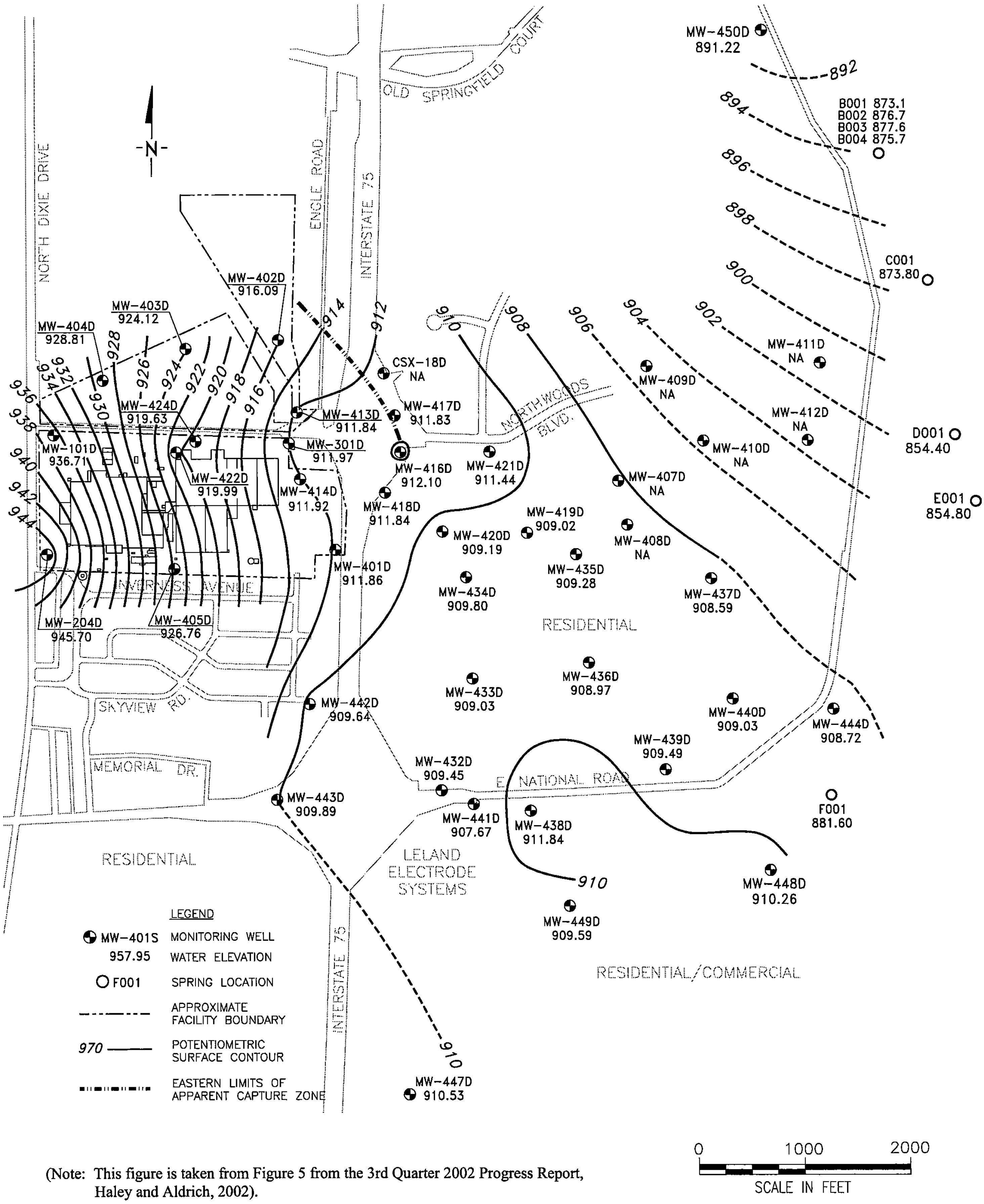
(Note: This figure is a re-creation of a draft figure created by Haley and Aldrich, 2002).

FIGURE 4-1. POTENTIOMETRIC SURFACE MAP FOR THE TOP OF ROCK, JULY 2002



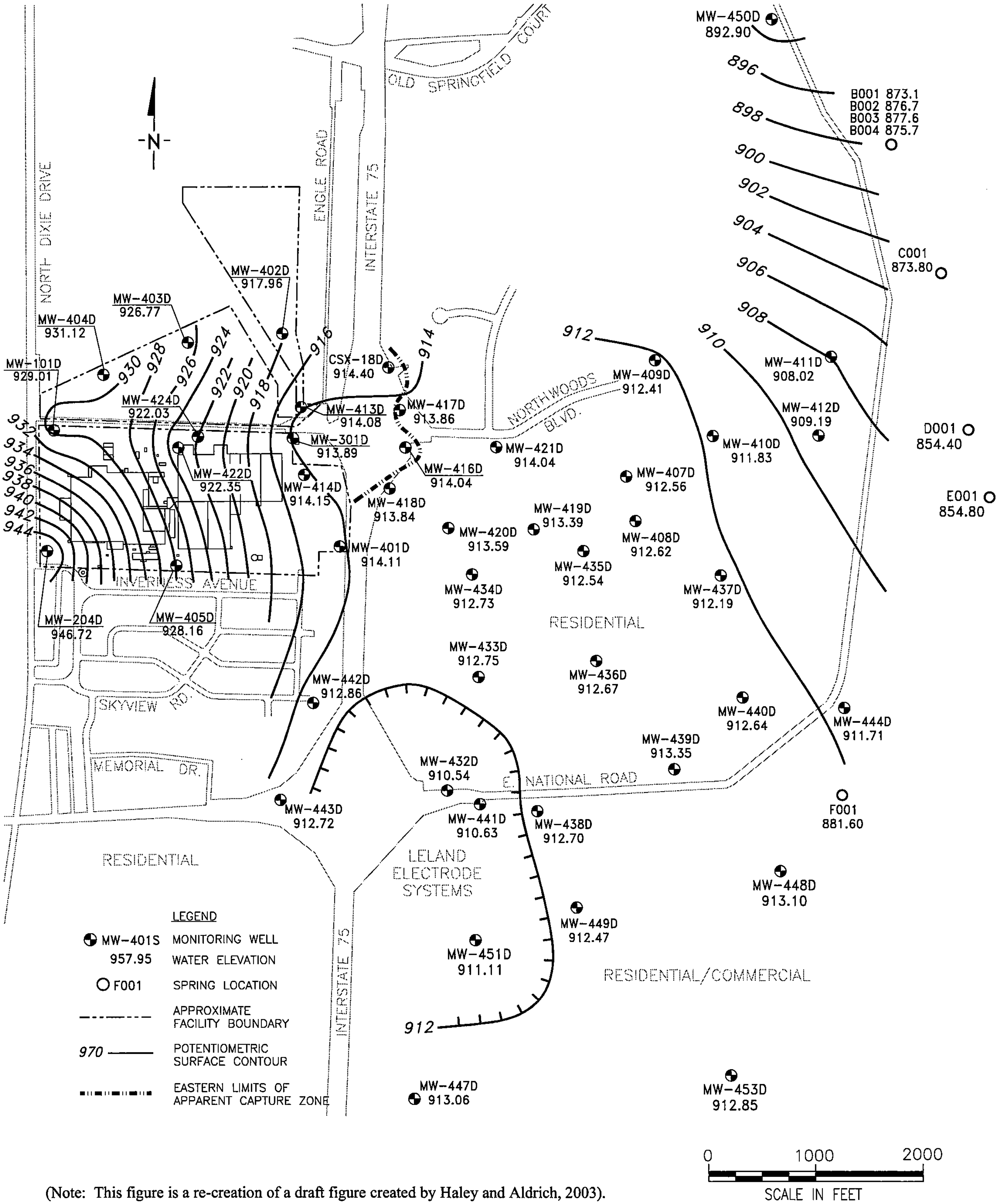
(Note: This figure is a re-creation of Figure 4 from the 3rd Quarter 2002 Progress Report, Haley and Aldrich, October 2002).

FIGURE 4-2. POTENTIOMETRIC SURFACE MAP FOR THE SUGAR ROCK, JULY 2002



(Note: This figure is taken from Figure 5 from the 3rd Quarter 2002 Progress Report, Haley and Aldrich, 2002).

FIGURE 4-3. POTENTIOMETRIC SURFACE MAP FOR THE SUGAR ROCK, FEBRUARY 2003



(Note: This figure is a re-creation of a draft figure created by Haley and Aldrich, 2003).